

**WHAT IS CLAIMED IS:**

1. A method of fabricating a semiconductor device, comprising the steps of:  
5 forming a lower electrode on a substrate;  
subjecting the lower electrode to a pre-annealing, wherein the pre-annealing is a  
thermal annealing under a selected atmosphere;  
forming a capacitor dielectric layer on the lower electrode; and  
forming an upper electrode on the capacitor dielectric layer.
- 10 2. The method of claim 1, wherein the lower electrode is formed of a metal.
3. The method of claim 1, wherein the lower electrode is formed by a CVD method.
4. The method of claim 3, wherein a metal organic material is used as a source of the  
CVD method
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5. The method of claim 1, wherein the capacitor dielectric layer is formed of a  
crystalline material.
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- 20 6. The method of claim 1, wherein the pre-annealing does not substantially change the  
materiality of the lower electrode.
7. The method of claim 1, which further comprises subjecting the capacitor dielectric  
25 layer to a crystallization annealing, and wherein a processing temperature of the pre-  
annealing is higher than that of the crystallization annealing.
8. The method of claim 1, wherein the pre-annealing is performed at a range of between  
about 350 ~ 750 °C.
- 30 9. The method of claim 1, wherein the selected atmosphere comprises a hydrogen gas.
10. The method of claim 1, wherein the selected atmosphere comprises a nitrogen gas.

Sub 13/10  
11. The method of claim 1, wherein the selected atmosphere is a mixed atmosphere.

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12. The method of claim 11, wherein the mixed atmosphere comprise a hydrogen and a nitrogen gas.

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13. A method of fabricating a semiconductor device, comprising the steps of:  
forming a lower electrode on a substrate;  
subjecting the lower electrode to a pre-annealing, wherein the pre-annealing is a treatment exposing the lower electrode under a plasma atmosphere;  
forming a capacitor dielectric layer on the lower electrode; and  
forming an upper electrode on the capacitor dielectric layer.

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14. The method of claim 13, wherein the lower electrode is formed of a metal, and the metal is formed by a CVD method.

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15. The method of claim 14, wherein a metal organic material is used as a source of the CVD method

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16. The method of claim 13, wherein the capacitor dielectric layer is formed of a crystalline material.

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17. The method of claim 13, wherein the pre-annealing does not substantially change the materiality of the lower electrode.

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18. The method of claim 13, which further comprises subjecting the capacitor dielectric layer to a crystallization annealing, and wherein a processing temperature of the pre-annealing is higher than that of the crystallization annealing.

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19. The method of claim 13, wherein the plasma atmosphere comprises a hydrogen gas.

20. A method of fabricating a semiconductor device, comprising the steps of:  
forming a metal lower electrode on a substrate, wherein the metal lower electrode is formed by a CVD method;

subjecting the metal lower electrode to a pre-annealing;  
forming a capacitor dielectric layer on the metal lower electrode; and  
forming an upper electrode on the capacitor dielectric layer.

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5 21. The method of claim 20, wherein the pre-annealing is one selected from the group consisting of a thermal annealing under a selected atmosphere and a treatment exposing the metal lower electrode under a plasma atmosphere.

10 22. The method of claim 21, wherein the capacitor dielectric layer is formed of a crystalline material.

23. The method of claim 21, wherein the pre-annealing does not substantially change the materiality of the metal lower electrode.

24. The method of claim 21, which further comprises subjecting the capacitor dielectric layer to a crystallization annealing, and wherein a processing temperature of thermal annealing is higher than that of the crystallization annealing.

25. The method of claim 24, wherein the processing temperature of crystallization annealing is about 650°C.

26. The method of claim 21, wherein the selected atmosphere comprises a hydrogen gas and the thermal annealing is performed at about 450°C.

25 27. The method of claim 21, wherein the selected atmosphere comprises a nitrogen gas and the thermal annealing is performed at about 700°C.

28. The method of claim 21, wherein the selected atmosphere is a mixed atmosphere including about 90% of nitrogen and about 10% of hydrogen by volume.

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29. The method of claim 28, wherein the thermal annealing is performed at about 450°C.

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